

SECTION 02310

GRADING, EXCAVATING, AND TRENCHING

LANL Master Construction Specification

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the LEM Civil POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within “stars” during editing.

Specification developed for ML-3 / ML-4 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Potholing.
- B. Grading: Clear, excavate topsoil, grade and dispose of materials at site.
- C. Excavation: Excavate, place, and compact earth at site.
- D. Trenching: Excavate trenches for utilities and install tracer wire/identification tape.
- E. Backfilling.
- F. Soil compaction and testing.

1.2 LANL PERFORMED WORK

- A. Obtain excavation/soil disturbance permit for Contractor.
- B. Mark location of known underground utilities.
- C. Document new and existing utility locations.
- D. Locate utility shut-off points prior to potholing.

1.3 DEFINITIONS

- A. Mechanical Excavation: Use of backhoes, jackhammers, trenchers, and similar powered digging machines; excludes vacuum excavators that are equivalent to hand digging.
- B. Utility: Any active or inactive buried pipe, duct, conduit, or cable in a primary or secondary utility system.

1.4 SUBMITTALS

- A. Submit the following in accordance with Section 01330, Submittal Procedures.
 - 1. Certifications from an independent testing laboratory that pipe bedding materials meet the specification.
 - 2. Certifications from an independent testing laboratory that base course materials, crushed stone or crushed or screened gravel meet the specification.
 - 3. Test reports of field-testing of material compaction and tracing wire continuity.
 - 4. Catalog data on identification tape and tracing wire.

1.5 QUALITY ASSURANCE

- A. When work or portions of work of this Section requires testing, notify LANL Construction Inspector.
- B. Ensure compacted fills are tested in accordance with Paragraph 3.10 and in compliance before proceeding with placement of next lift.
- C. Do not begin any groundbreaking until known utilities have been marked, an excavation/soil disturbance permit has been issued to Contractor; and Contractor has potholed utilities.
- D. Comply with OSHA 29 CFR 1926, Subpart P for excavation and trenching operation.
- E. Maintain a copy of Excavation/Soil Disturbance Permit and paper work on site.
- F. Perform pre-job briefing of Permit and associated safety and hazard documentation with workers performing the work.
- G. Ensure that engineering controls and required Personnel Protective Equipment (PPE) are used by workers during work activities to maintain safety, especially during jackhammering.
- H. Review and maintain the work within the established boundaries established by the permit.

1.6 SITE CONDITIONS

- A. Do not place and compact backfill material when the atmospheric temperature is below 35 degrees F, unless approved by LANL Construction Inspector.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil

1. Excavated soil material, graded free of roots, rocks larger than 1 inch subsoils, and debris.

Specify all earthen materials (soil and aggregate) to be used for fill or backfill in this section.

B. Fill and Backfill Material

1. Material consisting of non-plastic granular soils free of organic or other deleterious materials having a maximum particle size of 2 inches.
2. Obtain borrow material from the [Location of Borrow/Spoils Area] borrow/spoils site or other site approved by the LANL Construction Inspector.

C. Base Courses

1. Provide base course aggregate conforming to the New Mexico State Highway and Transportation Department (NMSHTD) Standard Specifications for Roadway and Bridge Construction. Conform to NMSHTD Specification for gradation, testing, and acceptance of base course aggregate, except as specified below.
2. Provide base course and aggregate composed of materials consisting of crushed stone, crushed or screened gravel, sand, or a combination of such materials. Provide base course and aggregate free from vegetable matter and other deleterious materials, including silt and clay balls.
3. Provide materials well blended and complying with the following requirements:

a. SIEVE SIZE	%PASSING
1 inch	100
3/4 inch	80 to 100
No. 4	30 to 60
No. 10	20 to 45
No. 200	3 to 10

- b. Regulate amount of crushing so that at least 50 percent, by dry weight, of plus No. 4 sieve material has 2 fractured faces.

- c. Liquid limit and plasticity index per ASTM D4318

Material passing No. 40 sieve:

Liquid Limit – 25 or less

Plasticity Index – 5 or less

- d. Los Angeles Abrasion per ASTM C131

Coarse Aggregate percent wear – 50 or less

- e. Soundness (5 cycle magnesium sulfate solution) per ASTM C88

Soundness Loss – 18 or less.

Specify materials used for fill or backfill trenches.

2.2 UTILITY TRENCH BED AND FILL MATERIALS

- A. Provide clean sand for pipe bedding material free of any organic or deleterious substance and having 100 percent passing 3/8 inch sieve and 4 percent passing No. 100 sieve.
- B. Provide fill and backfill consisting of non-plastic granular soils free of organic or other deleterious materials having a maximum particle size of 2 inches.
- C. Provide crushed stone and /or crushed or screened gravel free of any organic or deleterious substance and having 100 percent passing 1 inch sieve and 0 percent passing the 1/2 inch sieve.
- D. Warning Tape
 - 1. Use non-detectable plastic warning tape consisting of high visibility, color- coded, continuously printed, inert fiber reinforced polyethylene for direct burial service.
 - 2. Provide tape to the following criteria:
 - a. Minimum overall thickness: 4.0 mils
 - b. Minimum tensile strength: 1500 psi
 - c. Width: 6 inches
 - 3. Refer to trench detail on Drawing for warning tape color.
 - 4. Manufacturer: Bradley, Seton Name Plate Co., etc.

Tracer wire and test station(s) required when burying cast iron, ductile iron, or non-metallic piping. Refer to Civil Standard Drawing ST-G30GEN-3 for tracer wire detail.

- E. Tracer Wire: #10AWG THHN/THWN, yellow, solid copper.

F. Tracer Wire Test Station

1. Manufacturer: C.P. Test Services, Model-Glenn Test Station
2. Test Station: Plastic Pipe, cast iron cover, 2-point terminal box.

PART 3 EXECUTION

3.1 INSPECTION

- A. Verify stockpiled fill to be reused is approved by LANL Construction Inspector.
- B. Verify areas to be backfilled are free of debris, snow, ice, or water, and surfaces are not frozen.

3.2 PROTECTION

- A. Preserve staking, marking, or other designation until the designation is no longer needed for permitted work. If marking is removed or no longer visible, notify LANL Construction Inspector. The Inspector will contact LANL's Support Services Subcontractor to revalidate the excavation/soil disturbance permit by locating and marking the utility again.
- B. Protect existing structures from equipment and vehicular traffic.
- C. Maintain excavation free of standing water.
- D. Notify LANL Construction Inspector of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- E. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.
- F. Grade top perimeter of excavation to prevent subsurface water run-off into excavation.
- G. Protect disturbed soils, drainage ways and watercourses against soil erosion and sedimentation by employing Best Management Practices (BMPs) approved by LANL Construction Inspector.
- H. Approved BMPs shall be in place before soil-disturbing work begins.

3.3 PREPARATION

- A. Identify required contours and data.
- B. Notify LANL Construction Inspector 10 days prior to startup of construction to have LANL's Support Services Subcontractor identify known underground utilities and stake and flag locations. If a conflict exists between location of such obstacles and proposed work, promptly notify LANL Construction Inspector and arrange for relocations. Proceed in same manner if a rock layer or any other unforeseen conditions encountered underground make changes advisable.

- C. When necessary, compact subgrade surfaces to density requirements for backfill material.

3.4 WORKING WITHIN 5 FEET OF UTILITIES

- A. Stop work and notify the LANL Construction Inspector when an unmarked utility is encountered. The Inspector shall contact LANL's Support Services Subcontractor so the site can be re-examined by Utility Locators.
- B. If an underground utility is damaged or severed during excavation, immediately notify LANL Construction Inspector. LANL Construction Inspector will take immediate action to secure the area, notify the agency responsible for the utility so that the damaged section can be isolated, repairs initiated and other notifications made as required.
- C. Whenever practical, utilities shall be de-energized, isolated, and tagged-out. The decision not to de-energize shall be made by LANL Project Leader and Facility Manager as appropriate.
- D. Do not use mechanical excavating equipment within 5 feet of a marked, non-potholed utility. Mechanical excavation may commence within 5 feet of the underground utility only after the utility has been potholed, exposed, and well-marked and the Contractor is confident that there are no unexposed utilities in the excavation area.
 - 1. **Exception:** Use of mechanical excavating equipment may be used where known utility line depths and/or site conditions exceed limitations of hand or vacuum excavation. For purposes of this exception, excavate pothole perpendicular to surface locate markings for 2 feet on each side of marking to a predetermined depth. Mechanical excavation may proceed to within 18 inches of bottom of potholes under this exception. When deemed necessary, contractor may ask LANL Construction Inspector to contact LANL's SSS Mapping and Utility Documentation Group for consultation, checking of existing locate marks and remarking.
- E. Accomplish mechanical excavation at a distance no closer than 18 inches vertically and horizontally to potholed non-fully-exposed utility lines.
- F. Fully-exposed underground utilities shall be protected, supported, or removed and reinstalled as necessary to protect employees and the utility.
 - 1. If approved by LANL Construction Inspector, powered excavation equipment may be used closer than 18 inches to any fully-exposed utilities provided that these are marked/indicated with a prominent, tall flag-on-pole, plank, or other highly visible object so the equipment operator can clearly see their locations and avoid contact. Prior to such excavating, mark and obtain approval using Attachment 1, Utility Protection Plan Form.
- G. When unknown utility lines are marked and hand or vacuum excavation has gone 1 foot deeper than required and 3 feet to the left and right of a locate mark without finding the utility, stop excavating and contact the LANL Construction Inspector for consultation and remarking.

- H. Take care while hand excavating adjacent to utility line since hand tools such as shovels, picks, and digging bars can damage the utility line.
- I. During machine excavation, have a spotter place to actively monitor the positioning of the equipment.
- J. Hand-excavate obstructions (i.e., guy wires, anchors, bollards, fence posts, etc.) to be removed to determine their relationship to existing marked utilities prior to removal.

3.5 POTHOLING

- A. Prior to potholing the LANL Construction Inspector will notify LANL's SSS to locate utility shut-off points. SSS will ensure the shut-off points are field verified and determined operable.
- B. Pothole where existing buried utility lines are inside, or within 5 feet outside of excavation permit boundary limit.
- C. Accomplish potholing by hand excavation or through use of vacuum potholing equipment.
- D. Pothole at vertical and horizontal utility angle points, at excavation boundary limit, and as needed. Provide additional pothole where utility depths are unknown or are in sloped work areas where utility depths may vary.
- E. Manholes or valve boxes may be used as a pothole to verify depths and locations of utilities.
- F. Parallel Utilities: Pothole at 50 feet intervals where existing utilities parallel excavation and existing lines are located up to 6 feet outside excavation boundary. Hand or vacuum excavate non-conductive direct burial lines within 2 feet of excavation boundary along their entire length adjacent to excavation boundary, or pothole at 5 feet intervals.
- G. Backfill potholes to original or better than condition. Refer to Paragraph 2.2B.

3.6 GRADING

- A. Excavate topsoil from areas to be further excavated or regraded, and stockpile excess topsoil on site in area designated by LANL Construction Inspector.
- B. Remove vegetation, debris, unsatisfactory soil materials, and obstructions from ground surface prior to grading.
- C. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
- D. Match final grade in seeded and unpaved areas to match Drawing finish contours.
- E. Construct to a tolerance of [plus or minus 0.1 foot] from the established grade except for flow lines shown on Drawing [plus or minus 0.2 foot].

- F. Make changes in grade gradual. Blend slopes into level areas. Prepare finish grade to accept seeding by hand raking or as designated.
- G. Remove surplus excavated materials from site to [borrow/spoils site].

3.7 EXCAVATING AND TRENCHING

Specify project specific requirements. Refer to Civil Standard Drawings ST-G30GEN-4 for trenching detail.

- A. Excavate and trench subsoil as required for Work.
- B. Cut slopes in sound tuff rock material at 1 horizontal to 4 vertical or less. When cutting in soil, slope at 2 horizontal to 1 vertical or less, unless shored. Other slopes may be determined by engineering analysis.
- C. Cut trenches sufficiently wide to enable installation of utilities to allow inspection. Trenches may be benched, sloped, or shored to meet OSHA requirements. Refer to trench detail on Drawings for minimum trench widths.
- D. Do not interfere with normal 45 degree bearing splay of foundation during excavation work.
- E. Hand trim excavation and leave free of loose matter.
- F. Remove lumped subsoil, boulders, and rock.
- G. Correct errors in excavation.
- H. Take proper precaution, such as shoring, sloping, or using a trench box when working in a trench or excavation. Provide a person who is trained and knowledgeable of soil conditions and safety requirements to make safety determinations.
- I. Evaluate excavations 4 feet or deeper (or other excavation where employee exposure can be reasonably anticipated) daily and document by a designated competent person before employees are permitted to enter the excavation. Documented inspections on an excavation condition log.
- J. When an oxygen deficiency or hazardous atmosphere could be reasonably expected in trenches over 4 feet in depth, such as excavating near roadways, lift stations, sewer/gas lines, etc., the excavation shall be tested with a calibrated intrinsically safe monitoring device before employees are allowed to enter the excavation. If the atmosphere tests hazardous, do not enter the excavation or if chemical hazards exist or are created within the excavation, stop work immediately and contact the LANL Construction Inspector.

3.8 DOCUMENTING UTILITY LOCATION

- A. Do not cover new or exposed existing utilities until LANL's Support Services Subcontractor (SSS) has verified that utility locations have been documented in compliance with LANL standard reference system.
- B. Contractor Responsibility: Notify LANL Construction Inspector 5 working days in advance that new and exposed utilities will be ready for location verification.
- C. LANL Construction Inspector Responsibility: Notify LANL's SSS (Mapping and Utility Documentation Group) at 665-1051 immediately after being notified by Contractor.
- D. LANL's SSS (Mapping and Utility Documentation Group) will verify tracing wire continuity and GPS new and existing utilities.

3.9 BACKFILLING EXCAVATIONS/TRENCHES

Specify project specific requirements.

- A. Backfill and fill areas to contour lines and elevations shown on the Drawings.
- B. Backfill and fill systematically.
- C. Do not place backfill or fill material over frozen, wet, or spongy subgrade surfaces, including surfaces containing frost or ice.
- D. Recondition, reshape and recompact areas that are damaged by freezing.
- E. Place backfill and fill materials in continuous layers not exceeding 8 inches in loose depth.
- F. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.
- G. Compact each layer to required percentage of maximum density for the area.
- H. Compact layers uniformly before a succeeding layer is placed.
- I. Do not disturb or damage adjacent structures during compaction.
- J. Backfill against structures as follows:
 - 1. Do not place backfill against structure walls prior to verifying the concrete has been properly cured and is of required strength to resist stresses due to backfill.
 - 2. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structures to approximately the same elevation in each lift.
 - 3. When unbalanced pressures are likely to develop on walls:

- a. Continuously monitor for displacements,
- b. Erect shoring to counteract imbalance, if required, and
- c. Leave shoring in place until LANL Construction Inspector approves its removal.

K. Utility Trenches

- 1. Support pipe and conduit during placement of concrete or fill.
- 2. Install tracer wire (no splices) directly above buried non-metallic, ductile iron, and cast iron pipes and terminate at grade within a test station or as shown on the Drawings. Tracer wire shall not contact underground piping.
- 3. Visually inspect tracer wire prior to backfilling to ensure wire has not been nicked or cut, and that continuous unspliced wire runs between test station terminals.
- 4. Prior to utility tie-ins, perform an electrical continuity test for each run of tracer wire after backfill is complete. The Inspector will notify LANL's SSS (Mapping and Utility Documentation Group) to verify tracer wire continuity and GPS new and existing utility lines.
- 5. Install non-detectable plastic warning tape 12 inches below finish grade and directly above buried utility. Visually inspect warning tape prior to backfilling to ensure tape is continuous and not cut.

3.10 SOIL COMPACTION AND TESTING

- A. Control soil compaction during construction to provide the minimum percentage of density specified for each area as determined according to ASTM D1557, Method A or D.
- B. Where subgrade or layer of soil material must be moisture-conditioned before compacting, uniformly apply water to surface of subgrade or layer material to prevent free water appearing on surface during or subsequent to compacting operations.
- C. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.
- D. The allowable percent variation from optimum moisture is plus or minus 2 percent.
- E. The paragraphs below identify location and compaction required as a percentage of maximum density and optimum moisture measured using ASTM D1557.
 - 1. Compact fill in 8 inch lifts that will be beneath concrete and asphalt structures to [95] percent of maximum density.
 - 2. Compact fill in 8 inch lifts that will be beneath unpaved areas to [90] percent of maximum density.
 - 3. Compact new aggregate base course that will be beneath asphalt structures to [95]

percent of maximum density.

4. Compact pipe bedding to [90] percent of maximum density.

F. The Contractor shall employ a certified independent testing agency to perform testing and is responsible for the following:

1. Verify fill material to be placed is within the stated specifications, and laboratory testing is complete.
2. Verify that moisture-density relationship, ASTM D1557, for each soil type to be placed is completed.
3. Determine field density of in-place material in accordance with any of the following methods:
 - a. Nuclear Method, ASTM D2922,
 - b. Rubber-Balloon Method, ASTM D2167.
 - c. Sand-Cone Method, ASTM D1556.
4. Determine field moisture content in accordance with either of the following methods:
 - a. Nuclear Method, ASTM D3017, or
 - b. Laboratory Determination, ASTM D2216.

5. Frequency of Tests

Specify location and frequency of testing.

- a. One test per [2000] square feet for each lift of compacted fill material or fraction thereof, but not less than [3] tests per 8 inches maximum for each lift.
- b. One test per [50] linear feet of trench per 8 inches maximum for each lift.

END OF SECTION

Do not delete the following reference information:

FOR LANL USE ONLY

This project specification is based on LANL Master Construction Specification Rev. 2, dated January 24, 2003.

ATTACHMENT 1

Utility Protection Plan

Complete and receive approval from LANL Construction Inspector before mechanically excavating within 18" of a fully-exposed underground utility line in accordance with this Specification.

Description of Utility:

Description of Installed Marking/Flagging Measures (e.g., tall flag-on-pole, plank, etc.):

Sketch:



Submitted by: _____ (Contractor Name/Date)

Witnessed/Approved by: _____ (LANL Const Inspector/Date)